

IN THE SPECIFICATION

At page 2, please replace the paragraph at lines 12-19 with the following paragraph:

B2

Increasing concentration of Mg in HAp has the following effects on its properties: (a) gradual decrease in crystallinity, (b) increase  $\text{HPO}_4$  incorporation, and (c) increase in extent of dissolution. Magnesium is closely associated with mineralization of calcified tissues, and indirectly influences mineral metabolism. It has been suggested that magnesium directly stimulates osteoblast proliferation with an effect comparable to that of insulin (a known growth factor for osteoblast). Thus, it becomes possible to tailor the physicochemical properties of HAp, as well as its biocompatibility and bioactivity, by controlling the Mg substitution of the HAp lattice structure.

At page 4, please replace the paragraph at lines 5-11 with the following paragraph:

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Therefore, according to one aspect of the present invention, a stable, phase-pure magnesium-substituted crystalline hydroxyapatite is provided containing from about 2.0 to about 29 wt% magnesium, wherein at least 75 wt% of the magnesium content is substituted for calcium ions in the hydroxyapatite lattice structure. The Mg-HAp of the present invention forms as crystal agglomerates. The present invention therefore also includes particles of the Mg-HAp of the present invention having a particle size between about 5 nm and about 100 microns.

At pages 7-8 please replace the two paragraphs from page 7, line 19 to page 8, line 5 with the following two paragraphs:

B3

With stirring of the aqueous slurry/solution, the ion sources are mechanochemically reacted, typically by the application of physical force to the water-insoluble ion sources or insoluble apatite precursors that are suspended as a slurry in the aqueous reaction medium containing the water-soluble ion sources. Preferred mechanochemical reaction processes comminute the ion source slurry particles, preferably by milling or grinding the water insoluble

B3  
cont  
ion source particles with heating of the aqueous reaction medium into which the water-soluble ion source has been dissolved. Preferred methods at the same time frictionally heat the aqueous reaction medium/slurry while the slurry particles are being milled or ground, so that the mechanochemical and hydrothermal processes are performed simultaneously.

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Multi-ring media mills are preferred, which consist of a central rotating stainless steel shaft, which drives a plurality of stainless steel sub-shafts (sleeve-lined with zirconia-toughened alumina) that are connected symmetrically to the central shaft. Each sub-shaft contains a plurality of stacked zirconia rings, which rotate eccentrically around each sub-shaft. When the central shaft is rotating, the zirconia rings on the sub-shafts are moved by the centrifugal force radially outwards, applying force on the inner wall of the milling vessel, which is ceramic lined. Solid slurry particles located between the rotating rings and the liner wall are consequently comminuted.

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At page 9, please replace the two paragraphs at lines 17-29 with the following two paragraphs:

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B4  
The crystalline Mg-HAp will have a magnesium content between about 2.0 and about 29 wt%, with levels between about 3.5 and about 28.4 wt% being preferred. Levels between about 5 and about 25 wt% are even more preferred, with a level of at least 10 wt% being most preferred. The crystalline Mg-HAp of the present invention forms crystals agglomerates having an approximate particles ranging in size between about 5 nm and about 100 microns.

The crystalline Mg-HAp of the present invention is useful in the preparation of compounds for use as granular fill for direct incorporation into the hard tissues of humans or other animals, and as bone implantable materials. The present invention thus includes granular fill compounds, bone implant materials, tooth filling compounds, bone cements and dentifrices

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cont containing the Mg-HAp of the present invention. The products are formulated and prepared by substituting the Mg-HAp of the present invention for HAp in conventional HAp-based products. The compounds may be prepared in the form of metallic and polymeric Mg-HAp composites.

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At page 12, please replace the paragraph at line 2-11 with the following paragraph:

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135 **Example 2 - Mechanochemical-hydrothermal synthesis of  $\text{Ca}_7\text{Mg}_3(\text{PO}_4)_6(\text{OH})_2$**

$\text{Ca}(\text{OH})_2$ ,  $\text{Mg}(\text{OH})_2$  and solid  $(\text{NH}_4)_2\text{HPO}_4$  (analytical grade, Alfa Aesar, Ward Hill, MA) were used as reactants for the synthesis of Mg-HAp. First, a suspension containing a powdered mixture of 19.150 g  $\text{Ca}(\text{OH})_2$  and 6.717 g  $\text{Mg}(\text{OH})_2$  in 350 mL of deionized water was prepared inside a 500 mL glass beaker. Subsequently, 29.028 g of  $(\text{NH}_4)_2\text{HPO}_4$  powder was slowly added to the same beaker at constant vigorous stirring using a magnetic stirrer for about 10 min. The  $(\text{Ca}+\text{Mg})/\text{P}$  molar ratio in the starting slurry was 1.67. The presence of water adsorbed on all reactants was measured by thermogravimetry to maintain the targeted stoichiometries. The pH of the slurry was about 10.2, measured using a glass electrode connected to a pH-meter (Accumet Model 805 MP, Fisher Scientific, Pittsburgh, PA) and calibrated with respect to a buffer solution (pH=10.00, Fisher Scientific).

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At pages 12-13 please replace the paragraph at page 12, line 22 to page 13, line 2 with the following paragraph:

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136 The washed solid phase was dried in an oven at 70°C for 24 h (Isotemp oven, model 230G, Fisher Scientific) and ground into powder. The synthesized Mg-HAp powder contained a fraction of unreacted  $\text{Mg}(\text{OH})_2$ . Therefore, it was suspended in 0.2 M ammonium citrate aqueous solution. The ammonium citrate solution was prepared in a 250 mL glass beaker by dissolving 3.843 g of solid citric acid (reagent grade, Aldrich, Milwaukee, WI) in 200 mL of distilled water and subsequently slowly adding ammonia solution (reagent grade, Fisher

contained a fraction of unreacted  $\text{Mg}(\text{OH})_2$ . Therefore, it was suspended in 0.2 M ammonium citrate aqueous solution. The ammonium citrate solution was prepared in a 250 mL glass beaker by dissolving 3.843 g of solid citric acid (reagent grade, Aldrich, Milwaukee, WI) in 200 mL of distilled water and subsequently slowly adding ammonia solution (reagent grade, Fisher Scientific) to yield a pH of 10. 1.0 g of the Mg-HAp containing ~~unreacted~~ unreacted  $\text{Mg}(\text{OH})_2$  was then suspended in the solution. The dissolution of the  $\text{Mg}(\text{OH})_2$  was accomplished under a vigorous stirring using a magnetic stirrer for 24 h. This procedure was repeated once under the same conditions, in order to completely remove the  $\text{Mg}(\text{OH})_2$  phase.

**In The Claims:**

Claim 6 has been amended as follows:

6. (Amended) A method for the preparation of phase-pure crystalline magnesium-substituted hydroxyapatite comprising mechanochemically and hydrothermally reacting simultaneously a source of calcium ions, a source of magnesium ions, a source of phosphate ions and a source of hydroxide ions, at least one of which is soluble in water, in a aqueous reaction medium until said magnesium substituted-hydroxyapatite is formed.